

Diathermy

Medical and Surgical

Simplified



Published by

H. G. FISCHER & CO., Inc.

Physical Therapy Headquarters

2323-2337 Wabansia Ave.

Chicago, Ill.

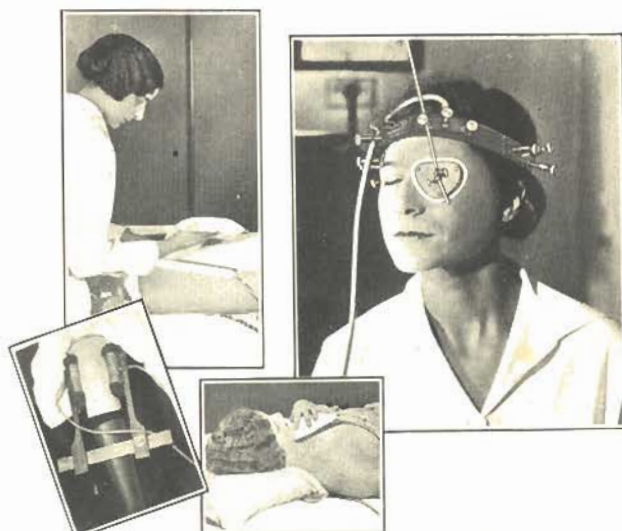
Copyright, 1928
H. G. Fischer & Co., Inc.

Introductory Note

Diathermy has proven of such great value as an aid in the treatment of a large number of medical and surgical diseases, that no physician or surgeon can afford to deprive his patients of the benefits to be derived from this agent.

When one considers that some of our greatest authorities, both in this country and abroad, have again and again come out in favor of what they were pleased to term "the newer medicine and surgery," when one recalls the astoundingly large number of reports in the literature showing therapeutic successes or at least improvements in many intractable medical and surgical conditions, when one realizes that recognized faculties of medicine are beginning to teach the use of this agent as part of the regular curriculum, it is not astonishing that the number of prominent physicians and surgeons making extensive use of Diathermy is growing from day to day.

There seems to prevail the impression that Diathermy requires the use of costly apparatus, and that the technic is fraught with many difficulties. We show in the following pages that while a reliable apparatus is essential for successful therapy, the outlay involved is comparatively small. A perusal of this brochure will convince any earnest seeker after information that the technic is not unusually difficult to acquire.



Various applications of electrodes in applying Diathermy

Everything new, at first glance, appears strange and complicated, but once a practitioner has made up his mind to acquire the necessary knowledge, all difficulties will be overcome with ease. We



Above: Portable Diathermy Outfit
"G 2" on Hospital Cart

those who desire to delve more deeply into this vast subject.

Our Research Department is ever ready to assist ethical physicians in obtaining whatever information they may desire on all Diathermy problems.

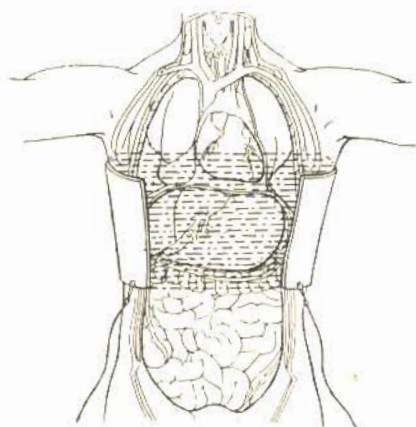
Finally, we desire strongly to impress the reader with the fact that Diathermy must not be looked upon as a panacea replacing accepted medical and surgical methods of treatment. Diathermy is, however, a valuable therapeutic adjunct in medi-

have endeavored in this booklet to explain in the simplest possible way what Diathermy is, what it will do, when it is indicated and when contraindicated, and we have given general directions for its application in a language freed from technicalities.

No claim is made that we have exhausted the subject, for, on the contrary, we have purposely restricted ourselves to the elementals, so that the application of Diathermy can be carried out intelligently from the very beginning. The last section of the booklet contains certain technical matter which may prove interesting reading to



Application of electrodes in Gallstone Colic



Above illustration shows effect of Diathermy current as used for "heating through" the entire field during an abdominal operation, according to Dr. Crile's method

cine because it enhances therapeutic results. In certain surgical diseases, especially the malignant growths regarded as unsuitable for classic surgery, it will prove the only means to remove diseased structures, while in a number of minor surgical conditions it is even superior to cutting operations.

It is evident, therefore, that medical and surgical Diathermy merits the most serious consideration by every conscientious practitioner of medicine.

Section I—Medical Diathermy

What Is Diathermy? By the word "Diathermy," which is coined from the Greek words "Dia," meaning through, and "Therme," meaning heat, we understand a method of treatment by the creation of warmth or heat *within* the human body, in contra-distinction to the application of heat to the surface of the body.

What Is the Difference Between Externally Applied Heat and Diathermy?

The usual application of heat such as by hot water, hot water bags, electrically heated pads, heated dry air, radiant heat and the like, affects merely the skin and an insignificant depth beneath and produces only temporary results ascribable to reflex action, while Diathermy can be made to affect both the superficial structures and all structures within the human body at will. It is applicable for prolonged periods at any desired degree with effects directly ascribable to the heat.

What Are the Principal Effects of Diathermy? The principal characteristic of Diathermy, unlike other currents used in therapy, is that it has no exciting influence on the sensory and motor nerves whatever, and, therefore, does not contract the muscles, but produces heat without giving the patient any other sense except that of a pleasant warmth—that is provided the Diathermy is properly applied.

This makes possible prolonged treatments without tiring the patient. Diathermy produces hyperemia not only of the smallest but even of medium size blood vessels, and this effect takes place principally in the depths of the tissues, the skin remaining more or less uninfluenced, differing in this respect from the ordinary application of heat.

The increase of circulation produces also an increase of leucocytes. Diathermy increases the rate of metabolism, eliminates toxic and waste material, relieves congestion and pain and relaxes irritated nerves.

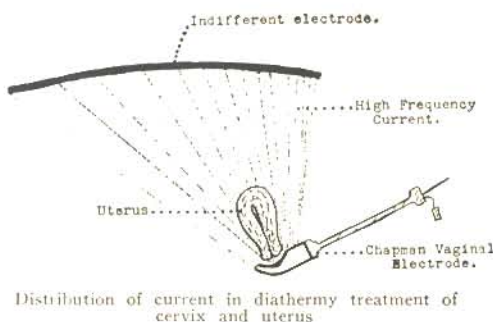
What Are the Therapeutic Indications of Diathermy? It is, according to its physiologic effects, the treatment par excellence in a large number of chronic inflammatory diseases. It is very useful in conditions where nutrition has to be increased locally (varicose ulcers, ununited fractures, deficient callus formation). It has proven a most valuable adjunct in the treatment of a number of acute inflammations (pneumonia, nephritis, neuritis, arthritis, epididymitis, in certain hypertensions (high blood pressure, hyperthyroidism), and in a large class of neuroses, local as well as general. For details, see the therapeutic section.

What Are the Therapeutic Contra-Indications? Diathermy should not be used whenever there is suppuration, owing to the danger that the infection may be caused to spread. It is, to cite an example, contra-indicated in acute appendicitis or cholecystitis when the presence of pus is even suspected. For details, see the therapeutic section.

How Is Diathermy Obtained?

By the use of a suitable apparatus yielding a so-called high frequency current, soon to be described. Such an apparatus receives its source of energy from a lamp socket on an alternating current main, such

as is now found in almost every house, office or public building. We must add here that where only the direct current is furnished by the district or city, a special device similar in appearance to a motor is required, which converts the Direct into Alternating current.



Both portable and stationary types of Diathermy apparatus are manufactured. A comparatively inexpensive apparatus (see section on apparatus) will suffice for practice in the office, hospital or in the patient's home, and will yield all the modalities needed for practically the entire range of medical Diathermy therapy and for most conditions requiring surgical Diathermy. Heavier, more elaborate appliances have, of course, certain advantages, especially when one desires to make extensive use of Diathermy.

What Is the High Frequency Current?

In principle, it is identical with the current which we use for industrial or even certain therapeutic purposes, but it differs in the frequency of the changes of direction, the oscillations generally mounting to over one million times a second. Moreover, the current produced must be

well balanced, and must come in rapid, evenly, successive trains of oscillations; a condition which is of far more importance than the amount of milliamperage



Auto-condensation Treatment

produced when the increased production is obtained without relation to the quality of the current.

A low frequency current applied to the human body produces motor and sensory effects, the patients describing them as unpleasant and even painful. Even weak currents of a low frequency can be applied only for a short time because the muscular contractions and reactions soon exhaust the muscle or group of muscles so treated. But the high frequency current leaves the nerves and muscles unaffected (the oscillations being too rapid), and the result is that nothing but heat is produced by the current when passing through the tissues.

The reader will find in a later section a brief historic note on the discovery and development of high frequency currents—a veritable romance of electrotechnics. In the technical section the interested reader will find all that a physician needs to know about the way the high frequency current is produced in the Diathermy apparatus.

What Is the d'Arsonval Current?

The high frequency current as used in modern therapy is often spoken of as the d'Arsonval current, in honor of Professor d'Arsonval of Paris, who was one of the first to point out the therapeutic value

of the high frequency current. Both terms, therefore, mean practically one and the same current, though the term d'Arsonval is no longer properly applicable to modern Diathermy apparatus.



Surgical Diathermy—Treatment of Carcinoma

What Is Autocondensation? Autocondensation is a method of administering general Diathermy virtually to the entire body.

Section II—Surgical Diathermy

What Is Surgical Diathermy?

By surgical Diathermy we understand the application of the high frequency current for the purpose of destroying human cells and tissue, or to divide them similar to the manner accomplished by a surgical knife.



Set of Surgical Diathermy Electrodes in Special Case

How Does Surgical Diathermy Differ from Medical Diathermy?

As far as the apparatus and current are concerned there is no difference, as one and the same apparatus is applicable for both uses, but there is a difference in the method of application, which will be explained in detail in a subsequent section. For convenience and for safety of application the surgical currents should be of much lower voltage than for medical Diathermy.

What Is the Histologic Effect of Surgical Diathermy?

As was already alluded to, in medical Diathermy care is taken to stimulate through the application of warmth up to a point where it is beneficial to the tissues, care being taken not to exceed a degree when the tissues may be harmed, but in surgical Diathermy every operation is planned to do the very thing which we avoid in medical Diathermy, namely to destroy the tissues by coagulation, or, to make it plain, by cooking the animal cells to heat the tissues to a point which prevents further blood supply, with its resultant sloughing.

What Is the Difference Between Surgical Diathermy and Cautery?

If we use a metallic applicator heated red either by a flame or by an electric current (thermocautery, galvanocautery) we destroy tissues by burning, as a result of conductive heat which has its bad effect of singeing adjacent tissues and the undesirable hardening of the surface. In applying a suitable electrode carrying a high frequency current—

surgical Diathermy—we obtain the coagulating effect without singeing any more tissue than we desire. This enables us to localize the destructive effect. In addition there is total absence of smoke so that the operative field is never obscured, a circumstance of tremendous value when one is operating in cavities, such as the mouth, nose, larynx, vagina or rectum.

**How Does Surgical
Diathermy Compare with
Surgical Dissection?**

Surgical Diathermy can never replace standard methods of operating surgically, because it has a comparatively limited field of application, but in the cases in which it is indicated it has certain advantages over the classic methods with the knife, so that surgical Diathermy must be looked upon as a valuable addition to surgical methods and therapy for several reasons. First, in malignant neoplasms surgical Diathermy, while destroying the diseased tissue does not open the lymph and blood channels, thereby preventing inoculation of the adjacent tissues. It has the advantage of being bloodless surgery, nay even hemostatic surgery, doing away with the need of sponges, artery forceps and the like for the control of bleeding, provided the blood vessels are not too large.



Surgical Diathermy—Hemorrhoids, Tonsils, Mole

What Are the Therapeutic Indications of Surgical Diathermy?

Surgical Diathermy is indicated primarily in accessible malignant growths and superficial cancers.

It is the method par excellence in the treatment of papilloma of the bladder. It is very often superior to the usual surgical procedures in the removal of external growths such as warts, nevi, angiomas and lupus, because removal can be accomplished with less disfigurement. Surgical Diathermy is a valuable means of sterilizing growths before their removal by surgical methods or immediately afterwards, thereby preventing suppuration and sepsis.

What Are the Contra-Indications of Surgical Diathermy?

Practically none as far as the restricted use of this agent is concerned. It is very likely that

the use of surgical Diathermy for desiccation will replace the knife in many instances not enumerated in the preceding paragraph. One objection to surgical Diathermy is the fact that it may cause ether fumes to ignite. Therefore, care must be exercised when using ether or any inflammable substance as an anesthetic, although ordinary precaution will avert any bad result. All this will be fully discussed in a subsequent section.

What Is Meant by Electrocoagulation?

Just what the

term implies — a coagulation or cooking of the tissues by the high frequency current. This term may be regarded as a synonym for surgical Diathermy.



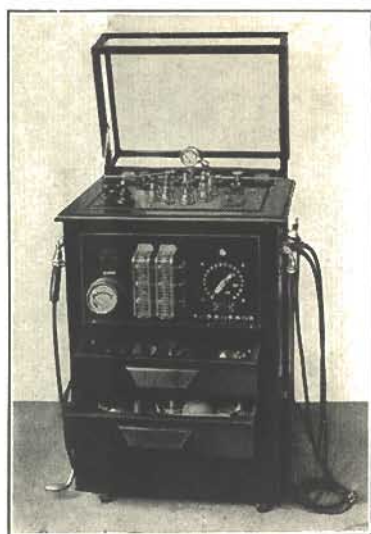
Model "V" Senior Diathermy Cabinet
(Surgical Tissue cutting current optional)

What Is Meant by Fulguration?

This is a term denoting a modified electro-coagulation, which is better designated as Desiccation. It is a monopolar method which has certain indications which will be fully appreciated by a study of the technics of surgical Diathermy.

What Is Carbonization?

As the very term implies, this is a method of surgical Diathermy which results in complete charring of the tissues. If electrocoagulation is continued beyond the stage when the tissues have become blanched, the tissues will become brown and then black—carbonization. As all that is needed for therapeutic purposes is coagulation, carbonization is not only unnecessary but decidedly disadvantageous, hampering penetration of the current into the depths, and causing adherence of tissue to the electrode so that when the instrument is to be moved to attack adjacent tissue the carbonized substance is removed with force, which may result in disagreeable hemorrhage. Carbonization has no place in therapy and should not be employed.



Fischer Eye, Ear, Nose and Throat
Combination Cabinet

Section III—Apparatus and Accessories

A certain familiarity with the appliances with which one is to work is of importance not only from a scientific but from an economic standpoint as well.

While the principal thing is to secure an apparatus that is manufactured with a view to efficiency, there are also other considerations which the physician must know in order to decide for himself the type he needs and desires. It is for this reason that in this section no attempt will be made to tire the reader with discussions of the technic of manufacture. We shall therefore restrict ourselves to a brief description of the diverse types of appliances from the standpoint of therapy.

We desire to impress the reader with the fact that while at first any of our apparatuses may appear somewhat strange, as compared with equipment for galvanic or faradic therapy, yet the apparently complicated "piece of machinery" is very easily understood and is easily applied. In fact, many physicians are employing nurses, technicians and lay assistants to administer treatments under their direction.

All our apparatus have this in common:

1. The office, hospital or home in which Diathermy treatments are to be given must have an electric lighting system. Most Diathermy machines are constructed that they may be connected with the alternating current light socket, that is, no special wiring is required. Where, however, only the direct current is available this supply must be first transformed into an alternating one by means of a converter, which in appearance resembles a medium size motor.

2. All our Diathermy machines are capable of yielding the necessary currents for medical Diathermy, surgical Diathermy, autocondensation and high frequency applications within the limits specified by us.

3. Each and every piece of apparatus which we manufacture is provided with detailed instructions for its installation and use.

Our Diathermy machines are best grouped into two types:

1. Portables.
2. Cabinets.

Each type has certain variations which will be described in detail.



Portable Diathermy Outfit "G2"

carried with comparative ease. This case measures 12 inches high, 14 inches wide and 22 inches long, and weighs but 50 pounds. Such an outfit is provided with all accessories needed for the various forms of Diathermy treatment, and may be purchased for the sum of \$265.00. There is a substantial deduction for cash, or the purchaser may have the option of making a small down payment and the balance in twelve monthly instalments. A similar outfit for office use is the G2 type shown above.

Example of Treatment Now let us assume for the purpose of demonstrating the manner of application that you have just such an apparatus before you, and that you desire to treat an inflamed knee-joint with Diathermy.

The patient with the knee exposed, is placed either on your examining table or preferably, on a simple padded table in a space or room set aside for this work, in the prone position. (It is well for even a beginner to set aside a special

Portable Apparatus As the name implies, this type is manufactured for the purpose of affording practitioners an apparatus that can be taken for treatment purposes to any place provided with electric light current. The least expensive and simplest of this type is the "Physician's Portable," which is illustrated below. It plainly shows a Diathermy apparatus set in a leatherette case, which can be closed and



Physicians' Portable Type "A"



Diathermy to the Knee with
Diathermy Clamp

room for physical therapy work. Experience has shown that there soon appears a great demand for this treatment, interfering with routine practice.) Certainly treatment to the knee could be given with the patient in the sitting position even on an ordinary chair but as the treatment should last for some time, even to half an hour, both patient and physician or attendant will find it more convenient with the patient in the prone position at suitable height.

Have the machine on a small stand nearby so that the current can be regulated with ease. Among the accessories you will find two cords insulated with rubber, and a roll of sheet (flexible) block tin. Using an ordinary household scissors, cut off two pieces of this tin of about 3 x 4 inches each. These block tin sheets are the electrodes by which the Diathermy current is to be carried to the knee-joint. For anatomic reasons you will place them laterally, one on the inner and one on the outer side of the knee, and before binding them in place with the elastic webbing (also furnished) coat both the skin and the under surface of the plate with soap lather, which insures good moist contact. Or, you may use the Diathermy Clamp, with mesh-covered sponge electrodes, as illustrated. These electrodes are now connected to the proper outlets on the machine by means of the rubber-covered cords. The main thing to watch is that the cords remain in good contact with the metal plates and the metal plates in good contact with the skin.

The patient is now ready for treatment.

As you throw on the line switch you will notice a faint glow from a ruby pilot lamp set in the top of the machine, indicating that the current is entering the apparatus. The treatment now resolves into the proper manipulation of the simple controls, each of which is plainly marked as to purpose. You will observe the needle on the milliampere meter has moved upward, indicating that the current is passing through the knee-joint, and the resistance of the tissues to the passage of this current does the rest. In a short time the patient tells you that he feels a pleasant warmth. You are now actually administering a medical Diathermy treatment and know that the technic as far as you have gone is comparatively simple. Fifteen

minutes will be sufficient time for the first treatment. Shut off the machine as you will be instructed, remove the electrodes, wipe the skin dry with a soft towel and your patient will undoubtedly leave the treatment table with the assertion that he feels greatly relieved.



Fischer Senior "FO" Diathermy Cabinet

Cabinet Apparatus In appearance, as you will notice from the illustrations, there is quite a difference between the large cabinet Diathermy machines and the portable, but in the operating technic and in general results this difference is not so marked. Certainly, the cabinet outfits are more powerful and for that reason are generally chosen for offices where the demand for physical therapy methods is fairly large, or for hospital work.

There are more current controls on the larger machines, and while they appear somewhat more complicated than the portable type, the whole operation and application are essentially the same in either instance. The larger type machines are also more expensive than the

portables, a fact which you will notice by turning to the end of this booklet, to the catalog section.

Section IV—Technic of Medical and Surgical Diathermy

The reader of the preceding section has received an idea what medical Diathermy is like. We have briefly given the physiologic effects of the high frequency current in the first section, and while detailed study of this current on the human organisms is highly interesting, and, indeed, essential to the intelligent application of this agent, space forbids our entering into details. In the following section we furnish the indications for all forms of Diathermy, arranged alphabetically by diseases and conditions, so that the reader can orient himself without much loss of time. Such a method, however, leads to merely empiric work, and as no physician cares to treat patients after a given pattern, the knowledge necessary to insure intelligent individualization must be obtained from the study of special work.



Use of Hollender-Cottle Head Band in Diathermy Treatment

Taking both our portable and cabinet types of apparatus for the purpose of illustrating technics, we already know that the high frequency current can be regulated from a weak, scarcely perceptible warming through of any desired part of the body, to such intense heating that the tissues are cooked and charred.

Medical Diathermy

Let us take up the problem of medical Diathermy first. We have already seen that while we can heat through any limited portion of the body, that there is such a thing as a general diathermization which is known as autocondensation.



Surgical Diathermy Electrodes and handle

A sharp line of demarcation between localized and general diathermization cannot be drawn, since

even local Diathermy raises somewhat the general body temperature, as can be verified by ordinary thermometry in the axilla or per rectum. This is due, of course, to the influence of Diathermy on the general circulation.

We see from the illustrations of the apparatus that each machine has several outlets or terminals from which the current is carried to the patient. Because two cords are necessary to carry this current, we refer to the method of treatment as "bipolar" in contradistinction to the "monopolar" current which, as we shall soon see, requires but one cord. We shall refer to the monopolar current further on in this booklet.

For strictly medical Diathermy only the bipolar current is applicable, in such a way that the active electrode is placed directly over the region to be treated, while the indifferent electrode is placed directly opposite, so as to insure a direct crossing of the part to be treated by the Diathermy current. The active electrode should be large enough for the purpose intended, but the indifferent electrode generally should be considerably larger.



Medical Diathermy in Pulmonary Tuberculosis

To illustrate by an example, let us assume that instead of a knee, as we described in the preceding section, we desire to treat a chronically inflamed gall bladder. The active electrode, which is usually a piece of flexible mesh or cut from a sheet of block tin, should be large enough to cover the region of the gall bladder — for instance 4 x 5 inches should be sufficient. For the indifferent electrode a piece of mesh or sheet block tin, about 6 x 8 inches, will be correct. This electrode is placed against the back opposite to the gall bladder region.

Mesh electrodes are extremely adaptable, but the

block tin electrodes have the advantage that they can be shaped and molded to fit the contours of the human body. These electrodes may be used again and again, until worn out, although care should be taken when using block tin to see that there are no wrinkles. If wrinkles are present they must be first smoothed out with a wooden roller, as even contact is absolutely necessary.



Diathermy Treatment in Genitourinary Disorders—Chapman Electrode

We have said that the electrodes must be thoroughly lathered and that they must lie in close contact with the skin, otherwise there is danger of sparking—an unpleasant sensation. It is often necessary to hold the electrodes in place with elastic bandages, but a pillow can generally be placed under the back to hold the lower electrode firmly, while sandbags may be employed to hold the electrodes on the anterior part of the body. In either event the application of these electrodes is quite simple.

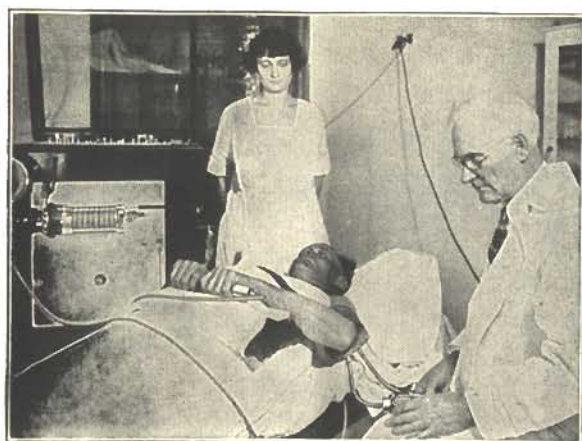
The First Law of Diathermy Treatment

Like in everything else in the practice of medicine, the first law is not to do harm. In their zeal to accomplish as much good as possible in the shortest time, novices are tempted to use too strong currents. That patients may be blistered and burned by such treatments there can be no doubt. Patients themselves complain when



Corbus Electrode in Diathermy Treatment of Endocervicitis

the sensation of heat becomes painful or annoying, and this should be carefully avoided not only by watching the amount of current passing through the milliamperemeter, but by cautioning the patient that as soon as the sensation of pleasant warmth is exceeded he should demand a reduction. Nothing is more apt to discredit Diathermy



Auto-condensation Treatment

than when a patient experiences unpleasant shocks or sparking, but this can be easily avoided with just ordinary care. How to start the machine and to terminate the treatment have already been described.

Auto-condensation

When it is desired to administer autocondensation for general therapeutic purposes, as for the reduction of high blood pressure, detoxication, et cetera, the technic is very simple. The patient need not even disrobe; he sits or reclines on a specially prepared pad (see above) in his ordinary clothing, although disrobing improves contact. The patient merely holds a long metallic handle, and there is no fastening of other electrodes required. The apparatus is operated just about the same as for giving a Diathermy treatment.



Auto-condensation Pad

Surgical Diathermy

We now come to a discussion of the technic of surgical Diathermy, and begin with the most important procedure—electrocoagulation.

Before applying this technic on patients, the novice will do well to perform a few simple experiments on a raw piece of meat. Obtain a small piece of fresh raw meat, just 3 or 4 inches square and probably $\frac{3}{4}$ of an inch thick, and place it on a piece of block tin slightly larger, this tin representing the indifferent electrode. The active electrode is a needle or small disc or knife-shaped device fitted into an insulated hard rubber handle.



Electro-coagulation test on piece of meat. Note the white area of coagulation produced by correct current



Charring, due to too strong a current in coagulation

Connect both the indifferent and the active electrodes by means of rubber-covered cords to the Diathermy machine. Grasp the rubber handle and bring the point of the electrode very close to but not in contact with the piece of meat. On closing the circuit, either with a hand or foot switch, you will notice a sparkling between the needle point and the meat. This is a method which formerly was called fulguration, but which we now refer to as desiccation. Alter the current volume, that is, increase and decrease the sparking and test the effect of the method on the meat. A few experiments like this will be found more worth while than hours of theoretic reading.



Correct coagulation with spike electrode produces white area



Too rapid coagulation with spike produces charring

The foot switch we refer to is an accessory provided with most outfits, which permits freedom of the operator's hands.

Continue to use the foot switch for the electrocoagulation experiments. These experiments are very similar in character to those just described, with this difference, that the needle electrode



Cauliflower Epithelioma successfully removed by surgical diathermy (electrocoagulation). Illustration above shows side view of the growth; below same patient after operation showing wound healed.



is introduced directly into the meat. For practice purposes, mark off with an indelible pencil an irregular space, and assume that this represents a cancerous growth which you desire to coagulate. Insert the needle electrode at any desired point in this space, and, assuming that after experimentation the apparatus is set for just the right strength of current, press down on the foot switch. You will produce a wheal of white, similar in appearance to a wheal one gets by injecting a solution with a hypodermic syringe immediately under the skin. This only takes a second or so, then stop the current by raising the foot, insert the needle into an adjacent spot, and proceed in this manner until the entire "cancer area" has been coagulated.

Experiments on animals (which should be anesthetized for that purpose in a separate room and then taken to the diathermy room, to prevent explosion) will prove helpful in determining the value of desiccation and electrocoagulation on the control of hemorrhage. The technic of electrocoagulation in actual practice does not differ from that just described.

Monopolar Desiccation This is a method of surgical treatment especially of value in minor external blemishes. An insulated handle to which is attached the needle electrode as used in electrocoagulation is employed. This handle is connected to the uniterminal on the machine, but the patient merely sits on a chair and no connection is made to the outfit. To explain further, only



Monopolar desiccation. Drawing shows the needle applicator held a short distance away from the skin, a shower of sparks passing to the lesion

one cord is used. Another method of monopolar desiccation is to connect the patient to this uniterminal and withdraw the current with a needle-like electrode held in the fingers of the operator.

It is almost needless to add that this type of work should be done under either general or local anesthesia. Local anesthesia is preferable whenever possible.

Diseases and Conditions in Which Diathermy Is Indicated

Below are listed the principal conditions in which various well known physicians have used Diathermy, either as the method of choice or as an adjunct to other methods. Literature describing technic and other details of treatment in conditions in which you are interested will be sent on request of any physician.

Acne	Cholecystitis, catarrhal (chronic)	Laryngitis, acute and chronic
Adenitis, acute and chronic	Coccygodynia	Leucorrhea
Adhesions, abdominal	Condyloma	Locomotor Ataxia
Adhesions, pleuritic	Conjunctivitis, acute and chronic	Lumbago
Amenorrhea	Cystitis, acute and chronic	Lupus Vulgaris
Anemia (secondary)	Dysmenorrhea	Menopause
Aneurysm	Endarteritis Obliterans	Myocarditis
Angina Pectoris	Endometritis	Myositis, traumatic
Angioma	Encuresis	Myositis, ossificans
Angioneurosis	Epithelioma	Nephritis
Ankylosis, fibrous	Epididymitis, acute and chronic	Neuralgia
Anuria	Fissure, anal	Neuritis
Arteriosclerosis	Fractures	Nevus
Arthritis, chronic	Gangrene, threatened	Onychia
Arthritis, gonorrheal	Gastralgia	Orchitis
Asthma, bronchial	Gastritis, catarrhal	Osteitis
Bronchitis, chronic	Gonorrhea, acute and chronic	Osteomyelitis
Buboes	Gout	Papilloma, bladder
Bursitis	Hemorrhoids	Paralysis, agitans
Carcinoma, external or inaccessible cavities	Insomnia	Periostitis
Cellulitis	Iridocyclitis Iritis, acute or chronic Iritis, gonorrheal	Pertussis
Cervicitis	Keloid	Pleurisy
Chancroid		Pneumonia
Claudication, intermittent		Prostatitis
		Raynaud's Disease
		Sarcoma
		Sciatica
		Sprains
		Tonsillitis
		Torticollis
		Ulcer, duodenal
		Ulcer, gastric
		Ulcer, varicose
		Vesiculitis
		Warts

Section V—Diathermy Therapy in Medicine and Surgery

The preceding alphabetic tabulation of the principal diseases and conditions in which medical and surgical therapy is indicated is, of course, neither complete nor instructive with regard to many factors with which every practitioner should be familiar.

Those interested can secure from us a book on Diathermy which will bring more detailed information.

Our purpose has been merely to show indications and certain contra-indications and stimulate the reader to thought and development, for, from the class of affections enumerated, the therapeutic indications of Diathermy suggest themselves as far as other affections are concerned, which have not been included in the table.

It is important to point out that Diathermy is a veritable specific in a comparatively few diseases, and, accordingly, other methods of treatment must not be neglected. This in turn presupposes an exact diagnosis and recognition of causative factors.

Finally attention is invited to the fact that we have not given the dosage in surgical Diathermy. This is due to the fact that each surgeon must find out in each particular lesion the dose required. When we desire to coagulate a large tumor, to illustrate by an example, we proceed as follows: All connections having been made to have a mild current, the apparatus is controlled by the foot switch. The needle electrode is inserted at any desired place of the growth and the current turned on by the foot for a few seconds. The tissue must become blanched. If it does not, the current is weak, and we increase it until we secure the desired effect. Now the operation proceeds in this manner: We coagulate a point, stop the current, withdraw the needle electrode and insert it alongside the coagulated area in order to coagulate the rest of the tumor progressively. It is only after each insertion of the needle that the current is turned on to prevent sparking, unless one deliberately desires this sparking to control oozing by dehydration.

Attention is invited to the fact that desiccation has been mentioned but not treated in the preceding table.

While this method is indicated in small benign external growths, such as warts, nevi, acne, and the like, it is not superior to coagulation, especially so because the surgeon himself is apt to receive sparks

if he does not avoid close contact of his hand or finger with the patient.

The principle of desiccation is that of mild coagulation. But the current must be strong enough to accomplish the desired effect.

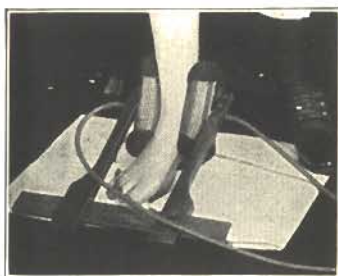
The simplest method is to connect the large cable supplied with each apparatus with the unipolar outlet, attach it at the hook end to a metal handle electrode which is held by the patient. Though this appears to be unipolar or, more correctly speaking, uniterminal, the current actually enters the patient's body. Place a finger against the body and both operator and patient will experience sparking. If instead of the finger the operator approaches a lesion with the needle electrode, desiccation will result, the intensity depending on the current volume. As the milliamperage meter does not register the current from the unipolar coil in any of our apparatus, the current strength must be regulated by the main controller and spark gaps in an empiric sort of way.

Historical Note

It was not so long since that practitioners of medicine knew only two electrical currents of therapeutic value—galvanism and faradism. These modalities became also important diagnostic tools. The character of the currents and their physiologic and therapeutic effects had been developed to a high state of perfection, and the apparatus improved to insure exactness and convenience in the administration of the currents; but these currents could not be utilized to produce heat by direct application to the human body.

Every electric current produces heat. From a purely physiologic point of view, Spitzka has demonstrated by actual tests that the temperature in the spinal column of criminals who had been executed by electricity reached 122° F. It was soon learned that while heat could be produced by weaker currents, such an effect could be obtained only at the cost of tissue cells. As regards the heating value of the galvanic and faradic currents, as used in the treatment of disease, it was too small to be measured and certainly nonexistent therapeutically.

A new impetus to electrotherapy was given by Tesla, when he discovered what became known in electro-



Diathermy to the Ankle, with
Diathermy Clamp



Diathermy to elbow, with
Diathermy Clamp

technics as the high frequency current. No one, not even this famous Serbo-American engineer, dreamt that the discovery of this current would add to medicine and surgery an agent of such tremendous value. Tesla himself noticed that the high frequency current produced a sensation of heat, but with the voltage employed and the further fact that the current was not continuous, the thought of utilizing it to create heat in the human body would have appeared far fetched to a medical man.

It was in 1892 that d'Arsonval of Paris suggested the therapeutic possibilities of the Tesla current. Four years later this physicist published his experiments, clearly demonstrating that the high frequency energy could be employed for heating beyond physiological limits. Bordier and Lecomte demonstrated later that by introducing metallic electrodes into the mouth and rectum of a guinea pig the animal could be killed by over-heating.

While d'Arsonval's name is justly identified with the high frequency current as applied to medicine, more credit is perhaps due von Zeynek (than any other scientist), who proceeded with the study of this current more systematically. Engaged in experimental work in the laboratory of Professor Nernst, he noticed that high frequency currents of a certain rate of oscillations produced no other sensation than that of warmth. In 1899 he published his observations and pointed out that while the heating effect doubtless is due to Joule's law, the Tesla oscillations are probably the sole means of equally warming the human body. Here we see a vision which today is reality.

Von Zeynek was handicapped by lack of suitable apparatus, but with dogged tenacity hung on to this thought, and, as we shall soon see, developed it until he attained his goal, so much so that the present writer, who has carefully gone over the literature on the subject with particular attention to priority, firmly believes that it is von Zeynek whom modern physical therapy owes a great debt.

Von Zeynek interested von Preyss in his investigations, and in the year 1904 both began experiments with a specially constructed Tesla apparatus. A year later von Zeynek demonstrated at Professor

Wolfler's clinic in Prague the treatment of a wrist joint, ankylosed as a result of gonococcic infection. At that time he frankly admitted that the apparatus he employed was not very satisfactory, that the tension was too high, that the oscillations were unsteady and that disagreeable sensations could not be avoided. He secured the aid of von Bernd at a time when the technicians of wireless telegraphy were busily engaged in experiments to produce continuous oscillations. The solution of the problem was found neither by Zeynek and his collaborators, Preyss and Bernd, nor by the multitude of technicians, but by the Danish engineer, Waldemar Poulsen. Bernd immediately grasped the value of the discovery, constructed an apparatus and began a series of tests on animals and on themselves, and finally applied their invention therapeutically in Professor Ortner's clinic in Innsbruck. There they had ten partly acute, partly sub-acute cases of arthritis and their successes were reported in the *Wiener Klinische Wochenschrift* in April, 1908.

They referred to this new method of treatment as Thermo-penetration, a name which they later abandoned in favor of Diathermy, sponsored by Doctor Franz Nagelschmidt of Berlin. This physician had doubtless carried on similar experiments independently, but as his first contribution on the subject did not appear until December, 1908, under the title "*Tabes und Hochfrequenzbehandlung*" (Locomotor ataxia and high frequency treatment), priority seems to belong to Zeynek, Preyss and Bernd. It is interesting to note that Nagelschmidt at first called this method of treatment Electrothermy.

In the wake of these rather modest beginnings comes a veritable avalanche of clinical experiments. In the United States, as perhaps in no other country, the value of Diathermy is grasped by high and low in the scientific world. In medicine, Kelley of Johns Hopkins sees in the high frequency current the "newer surgery" because of the potency of the current to destroy tissue, while no less an authority than Crile of Cleveland shows its great value as a preventative of surgical shock. A host of earnest workers have developed indications and technic, too numerous to be even mentioned in this brief sketch, and today we have a number of specialistic societies, congresses and periodicals exclusively devoted to physical methods of therapy in which Diathermy plays an important role. Colleges are establishing chairs for these newer methods of treatment, and no hospital is deemed properly equipped unless it has at least one reliable apparatus for medical and surgical Diathermy.

But what is of perhaps the greatest importance in signifying the fact that Diathermy has definite scientific value—and is not a mere fad—is the circumstance that the American Medical Association has undertaken measures which will insure a standardization of Diathermy apparatus.

What the future will bring forth can only be conjectured. The high state of technical attainment and the cumulative knowledge with regard to Diathermy in medicine and surgery afford each earnest physician the means to conveniently add original investigations and thus to make valuable contributions for the common good.